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"The 'Socio-Dynamic' paradigmatic approach to Social Representations: Anchoring, Positioning and Normative Context. Complementary Methodological and Transferable Skills Seminars"

European / International Joint Ph.D. in
Social Representation and Communication

Meta-Analysis: An Overview

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Meta-Analysis. An overview

Aims of the seminar

- **Give an overview of the meta-analysis**
  - **Steps in MA**
  - **Focus on some specific graphs**

Read criticially a MA. Check list

Make sense of accumulated data

Reviews

Explicit

Systematic

Replicable

Schulze, R. (2007)..

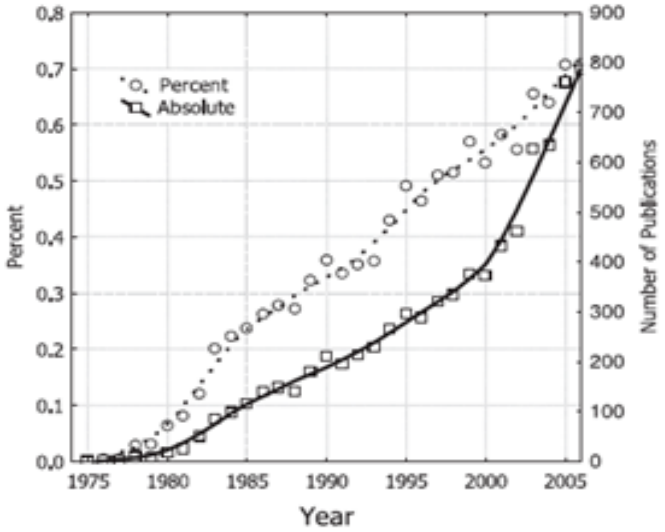


Figure 1. The absolute number and percentage of publications on meta-analysis in the database PsycINFO in the last 30 years.

The number of meta-analyses is increasing at a rapid rate.

What are the problems of narrative reviews?

Difficulty to handle too many studies

- Inclusion of selective studies
- Difficulty to analyze potential moderator variables
- Using studies with inadequate information to make conclusions or give subjetive weights to the studies

From narrative reviews to quantitative research synthesis

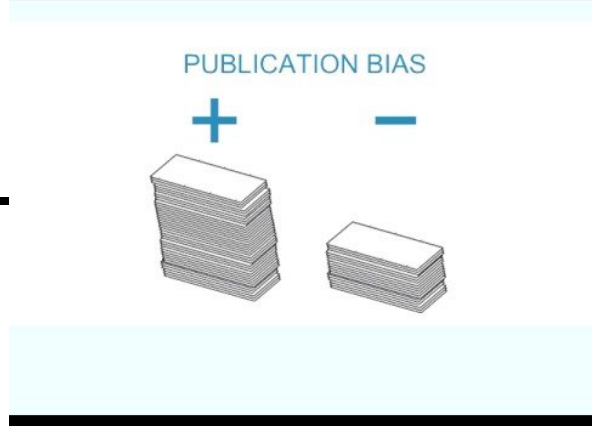
- **1960-70. First attempts at integration**
- **1976, Glass: Meta-analysis (Conference of *American Educational Research Association*)**

PHASES of META-ANALYSIS

1. PROBLEM
2. LITERATURE SEARCH
3. DEVELOPING A CODING SCHEME
4. TRANSFORMATION TO A COMMON MEASURE
5. DATA ANALYSIS
6. CONCLUSIONS
7. REPORT

Data Base
K studies

The problem of sampling bias



The problem of the publication bias

K studies

CONCLUSIONS

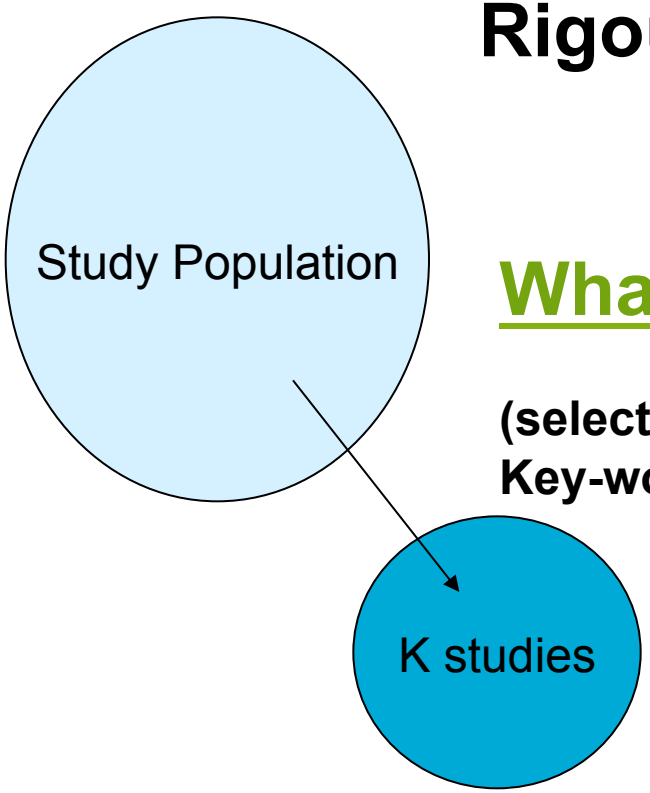
How many studies **NOT** found and **NOT** significant could change my Meta-analysis results?

X studies
In the file drawer
(Rosenthal, 1979)

Step 1: PROBLEM
Establish research question

- Comparison of treatment & control groups
- Pretest-posttest differences
- What is the correlation between two variables
- Moderators of an outcome

Step 2: LITERATURE SEARCH



Rigour and transparency

What to look for

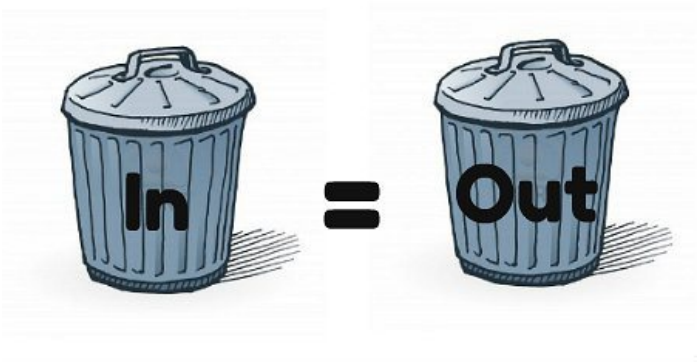
(selection criteria: time limit, type of publication, language, Key-words…)

REPLICABILITY

WHAT TO LOOK FOR

- Search for <u>every</u> study in the defined population

- Quality selection?
  Methodological quality dilemma



Quality Assessment

- "The validity of a systematic review ultimately depends on the scientific method of the retrieved studies and the reporting of data."

  Margaliot, Zvi, Kevin C. Chung. (2007)

- The most common way to assess and report study quality has been using a composite, numerical scoring instrument

More than 35 different quality assessment instruments have been published in the literature

JADAD SCORE

- **Randomization (2 points possible)**
  - 1 point if study described as randomized
  - Add 1 point if randomization method described and appropriate (e.g. random numbers generated)
  - Deduct 1 point randomization described and inappropriate

- **Double-blinding (2 points possible)**
  - 1 point if study described as double-blinded
  - Add 1 point if method of double-blinding described and appropriate
  - Deduct 1 point if double-blinding described and inappropriate

- **Withdrawals (1 point possible)**
  - Give 1 point for a description of withdrawals and drop-outs

HOW TO LOOK

No formal channels

- **Personal contacts**
- **Invisible schools**
- **Internet (listservs)**

Primary formal channels

- **Conference Programs and Proceedings**
- **Journals**
- **References in studies**

Secondary formal channels

- **Electronic databases**
- **Bibliographical reference volumes**
- **Citation index**

SELECTING RESEARCH
Inclusion/exclusion criteria

BEFORE literature search

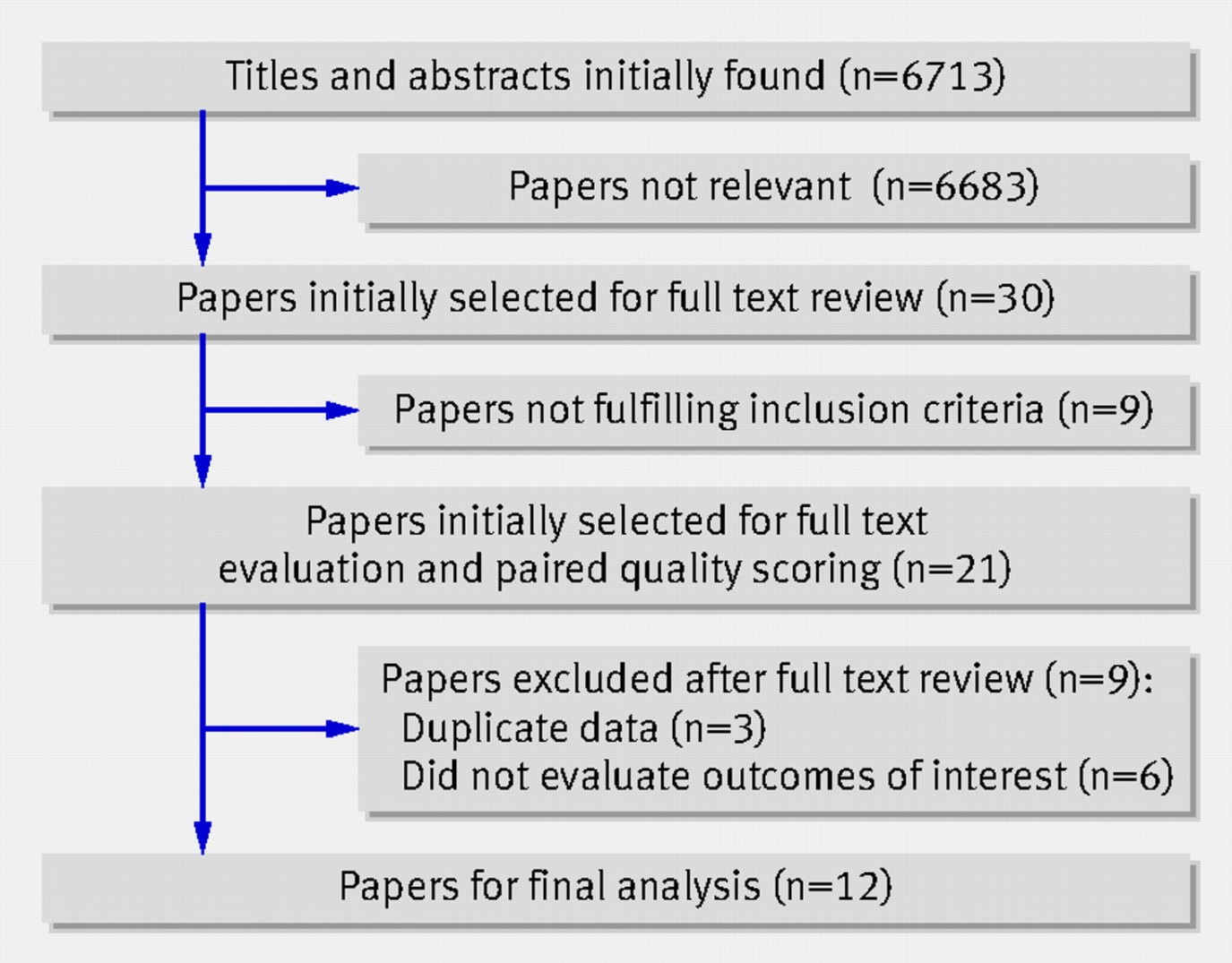
- **time limit**
- **Sources (publication type)**

DURING literature search

- **Language** 大志
- **Key-words**
- **Incomplete abstracts**

AFTER literature search

- **Not enough information**


Titles and abstracts initially found (n=6713)
Papers not relevant (n=6683)
Papers initially selected for full text review (n=30)
Papers not fulfilling inclusion criteria (n=9)
Papers initially selected for full text evaluation and paired quality scoring (n=21)
Papers excluded after full text review (n=9):
Duplicate data (n=3)
Did not evaluate outcomes of interest (n=6)
Papers for final analysis (n=12)

Step 3:

DEVELOPING A CODING SCHEME

Developing a code book

- The code book guides the coding process

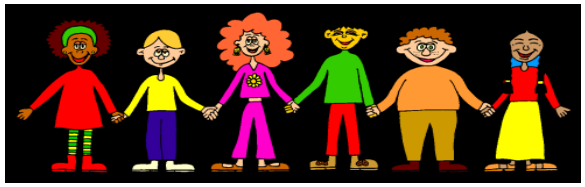
- Almost like a dictionary or manual

  "...each variable is theoretically and operationally defined to facilitate intercoder and intracoder agreement during the coding process. The operational definition of each category should be mutually exclusive and collectively exhaustive" (Brown et al., 2003, p. 208).

Step 3: DEVELOPING A CODING SCHEME
WHAT INFORMATION DO WE HAVE IN EACH STUDY?

- **Substantive features**
  (type of treatment, theoretical framework, etc…)

- **Pariticipants characteristics**



- **Methodological characteristics**
  (random assignment, representative sample)

- **Extrinsic characteristics**
  (year of publication, country…)

- **Statistical information**
  (step 4: transformation to a common measure)

Pilot coding

- Random selection of papers coded by both coders
- Meet to compare code sheets
- Where there is discrepancy, discuss to reach agreement
- Amend code materials/definitions in code book if necessary
- May need to do several rounds of piloting, each time using different papers

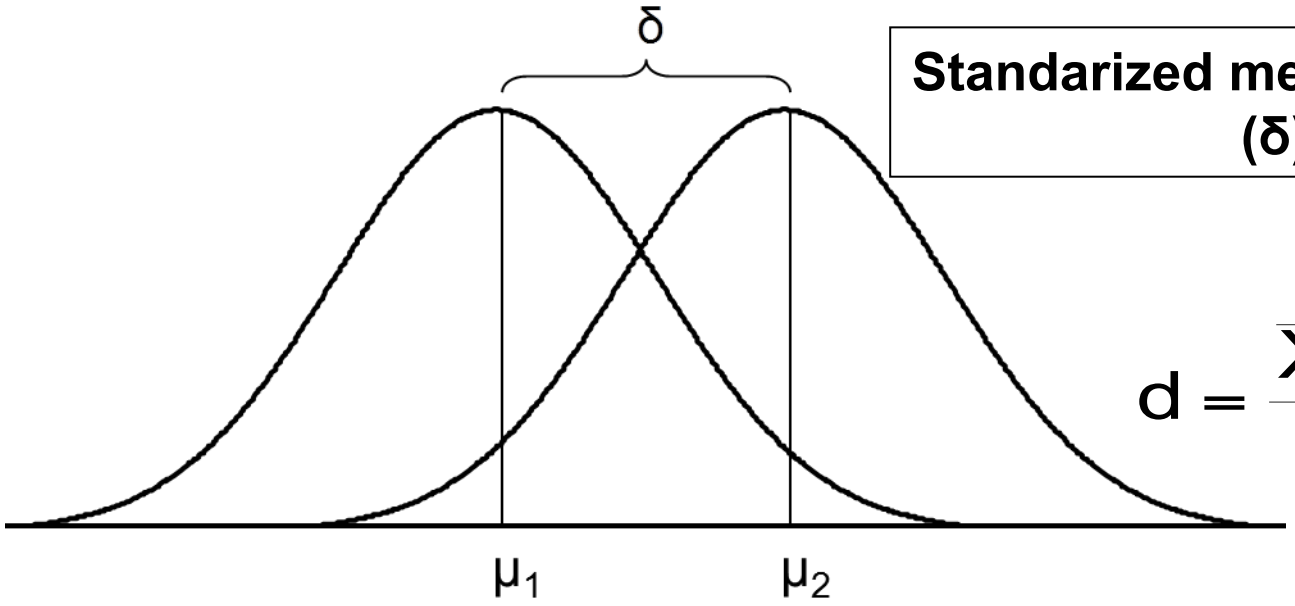
Step 4:

TRANSFORMATION TO A COMMON METRIC

Step 4: TRANSFORMATION TO A COMMON METRIC

Effect Size: The Key to Meta-analysis

- The effect size makes meta-analysis possible
- Represents the magnitude and direction of the relationship of interest
- Is independent of sample size
- Different meta-analyses may use different effect size indices (d, r, odds ratio)



Standarized mean difference (δ)

$$d = \frac{\overline{X}_1 - \overline{X}_2}{S}$$

Means and standard deviations

Correlations

P-values

F-statistics

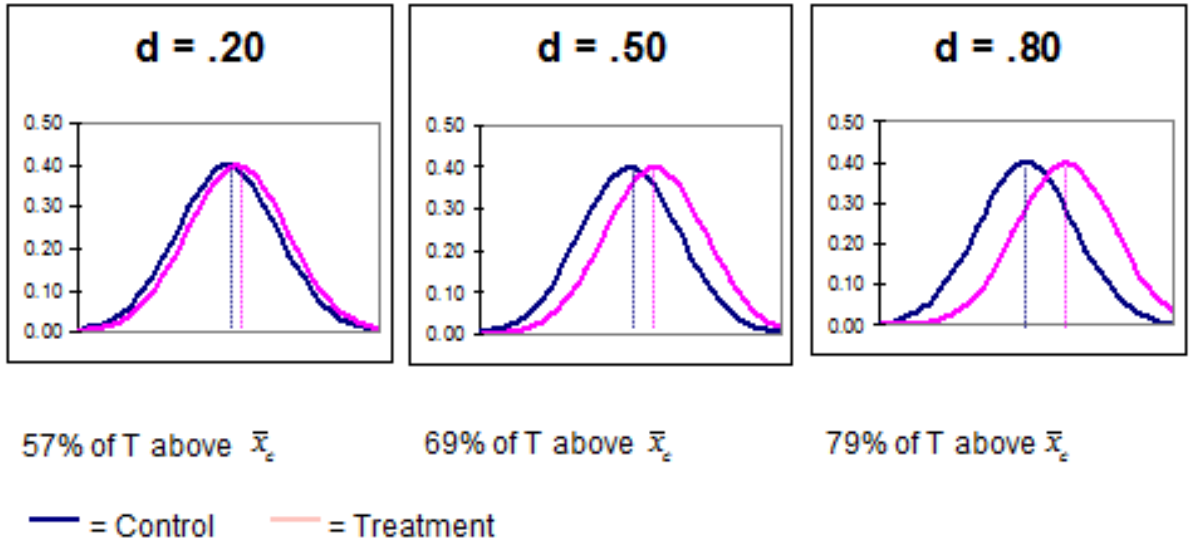
t-statistics

test

d

Almost all test statistics can be transformed into an standardized effect size "d"

Effect size as proportion in the Treatment group doing better than the average Control group person



Effect size calculation

- Standardized mean difference
  - Group contrasts
    - Treatment groups
    - Naturally occurring groups
  - Inherently continuous construct
- Odds-ratio
  - Group contrasts
    - Treatment groups
    - Naturally occurring groups
  - Inherently dichotomous construct
- Correlation coefficient
  - Association between variables

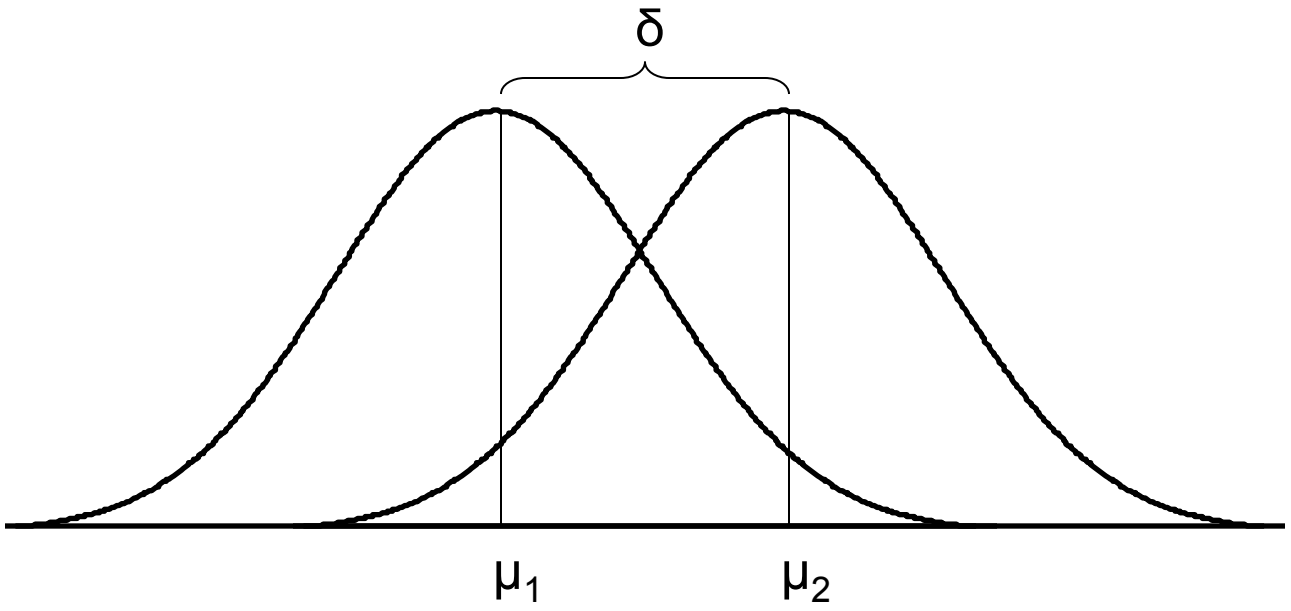
$$\overline{ES} = \frac{\bar{X}_{Males} - \bar{X}_{Females}}{SD_{pooled}}$$

$$\overline{ES} = \frac{ad}{bc}$$

$$\overline{ES} = r$$

EFFECT SIZE

Standarized mean difference (δ)



$$\delta = \frac{\mu_1 - \mu_2}{\sigma}$$

$$d = \frac{\bar{X}_1 - \bar{X}_2}{S}$$

General expression contrast statistical

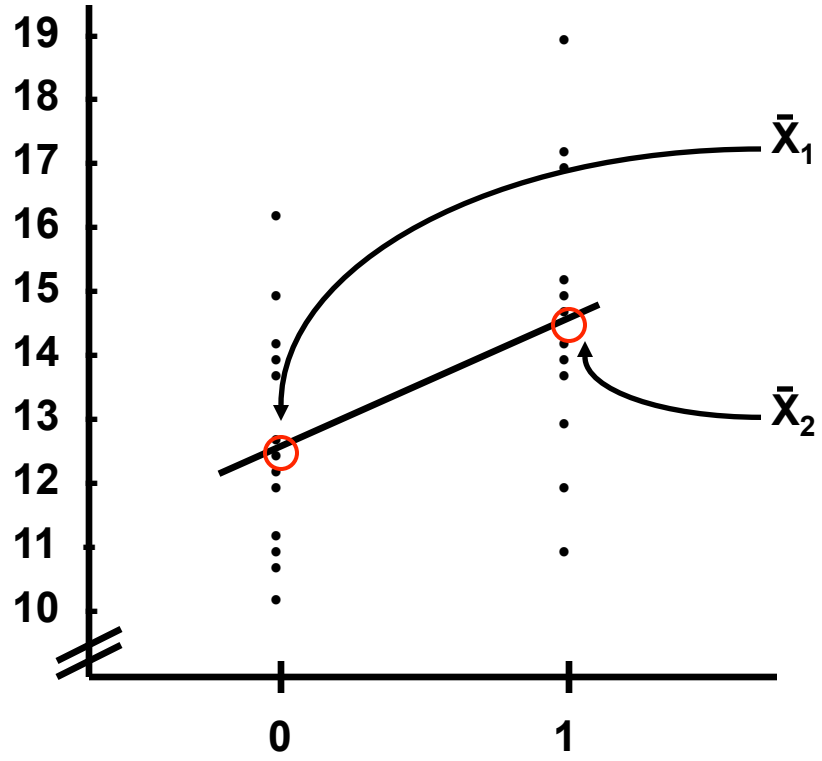
Significance proof = **Effect size** x **Sample Size**

Example: t proof

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\hat{S}^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} = \frac{\bar{X}_1 - \bar{X}_2}{\hat{S}} \cdot \frac{1}{\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} = d \cdot \frac{1}{\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

EFFEC SIZE

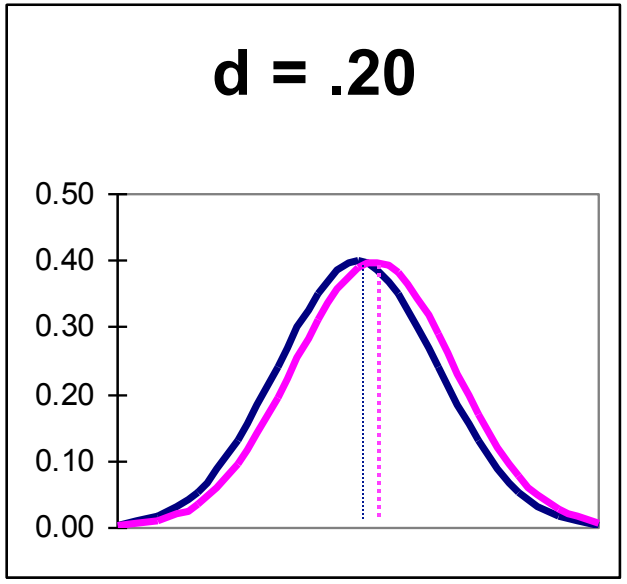
Pearson Correlation (r)

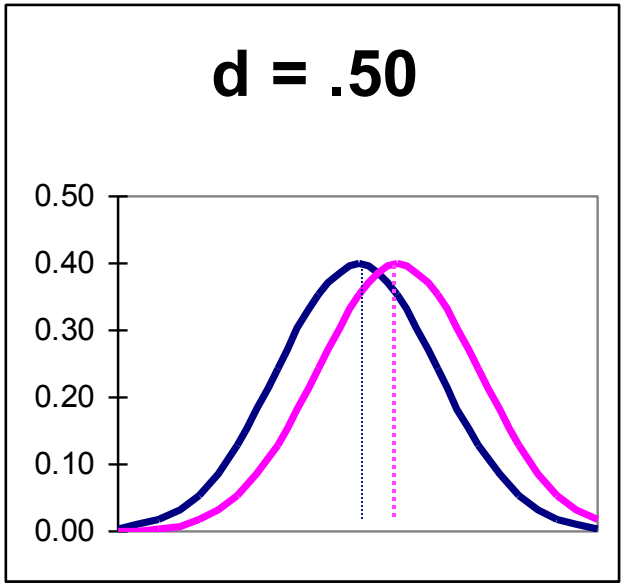


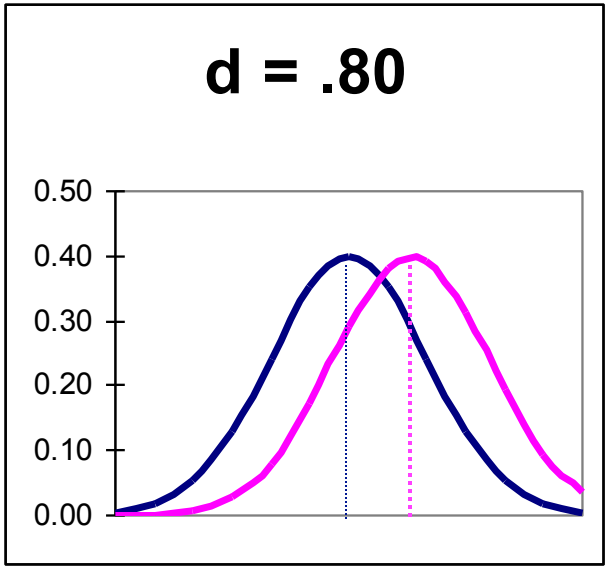
$$r = \sqrt{\frac{d^2}{d^2 + 4}} = \frac{d}{\sqrt{d^2 + 4}}$$

$$d = \frac{2 \cdot r}{\sqrt{1 - r^2}}$$

Effect size as proportion in the Treatment group doing better than the average Control group person







57% of T above $\bar{x}_c$

69% of T above $\bar{x}_c$

79% of T above $\bar{x}_c$

= Control = Treatment

Structuring a database

meta20_RMF example.sav [DataSet1] - SPSS Data Editor

File Edit View Data Transform Analyze Graphs Utilities Window Help

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align
1	study	Numeric	4	0	study identification	None	None	8	Right
2	g	Numeric	8	3	Glass's g	None	None	8	Right
3	d	Numeric	8	3	Hedges & Olkin's d	None	None	8	Right
4	varofd	Numeric	8	3	sampling variance of d	None	None	8	Right
5	nexp	Numeric	8	0	experimental group N	None	None	8	Right
6	ncon	Numeric	8	0	control group N	None	None	8	Right
7	ntot	Numeric	8	0	total sample size	None	None	8	Right
8	weeks	Numeric	4	0	duration of intervention	None	None	8	Right
9	rii	Numeric	8	2	reliability of test used	None	None	8	Right
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Data View | Variable View

SPSS Processor is ready

PHASES of META-ANALYSIS

1. PROBLEM
2. LITERATURE SEARCH
3. DEVELOPING A CODING SCHEME
4. TRANSFORMATION TO A COMMON MEASURE
5. DATA ANALYSIS
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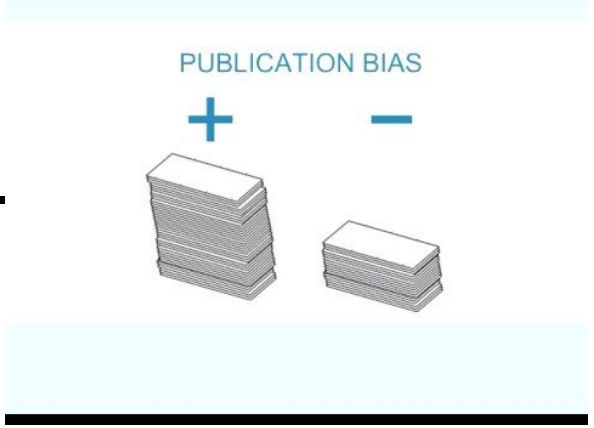
7. REPORT

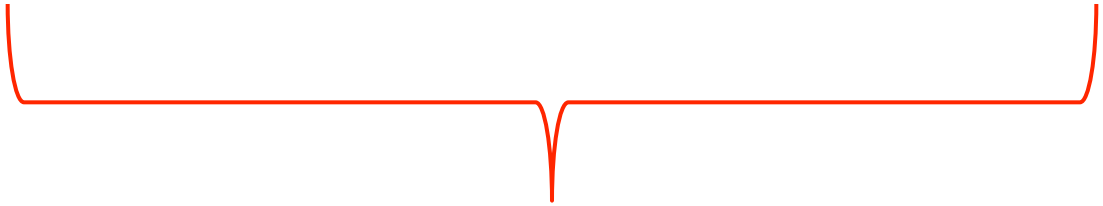
Data Base
K studies

The problem of sampling bias

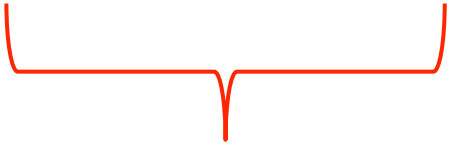


DATA BASE

STUDIES	CHARACTERISTICS									RESULTS			
	SUBSTANTIVE			METHODOLOGIC			EXTRINSIC						
SOURCE	Treatment. indiv/grupo	Medication	...	TYPE DESIGN	T YPE CONTROL GROUP	...	PUBLICATION YEAR	TYPE PUBLICATI ON	...	N_E	N_C	d r	p
1													
2													
3													
4													
-													
-													
k													



Moderator variables



Dependent variables

Inter-rater reliability

- Coding should ideally be done independently by 2 or more researchers to minimise errors and subjective judgements
- Ways of assessing the amount of agreement between the raters:
  - Percent agreement
  - Cohen's kappa coefficient
  - Correlation between different raters
  - Intraclass correlation

Questions

- What are the main advantages of a MA?
- What are the main steps in MA?
- What are the primary types of effect sizes?
- What sort of information can be used to calculate effect sizes?
- ….

PHASES of META-ANALYSIS

1. PROBLEM
2. LITERATURE SEARCH

Data Base
K studies

3. DEVELOPING A CODING SCHEME
4. TRANSFORMATION TO A COMMON MEASURE
5. DATA ANALYSIS
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The problem of sampling bias

STEP 5. DATA ANALYSIS

What is the estimated effect size for the K studies?

Global estimated Effect Size

$$\overline{ES} = \frac{\sum(w \times ES)}{\sum w}$$

Is that combined ES uniform?

YES

NO

Categorial models (ANOVA analogous)

Continuous models (regression models)

What is the combined Effect Size?

- We have a set of Effect Sizes (an ES per study or an ES per subsample within study)

- Studies with bigger samples (N) are more precise, so they should have more weight. Larger studies should carry more “weigth” than smaller ones

- For this reason each ES is weighted by its inverse variance

An **Example**

10 Effect size (ES) and their weights (w)

Study	ES	w
1	-0.33	11.91
2	0.32	28.57
3	0.39	58.82
4	0.31	29.41
5	0.17	13.89
6	0.64	8.55
7	-0.33	9.80
8	0.15	10.75
9	-0.02	83.33
10	0.00	14.93

$$\overline{ES} = \frac{\sum (w \times ES)}{\sum w}$$

$$\overline{ES} = \frac{\sum (w \times ES)}{\sum w} = \frac{41.82}{269.96} = 0.15$$

$$S_d^2 = \frac{n_E + n_C}{n_E \cdot n_C} + \frac{d^2}{2 \cdot (n_E + n_C)}$$

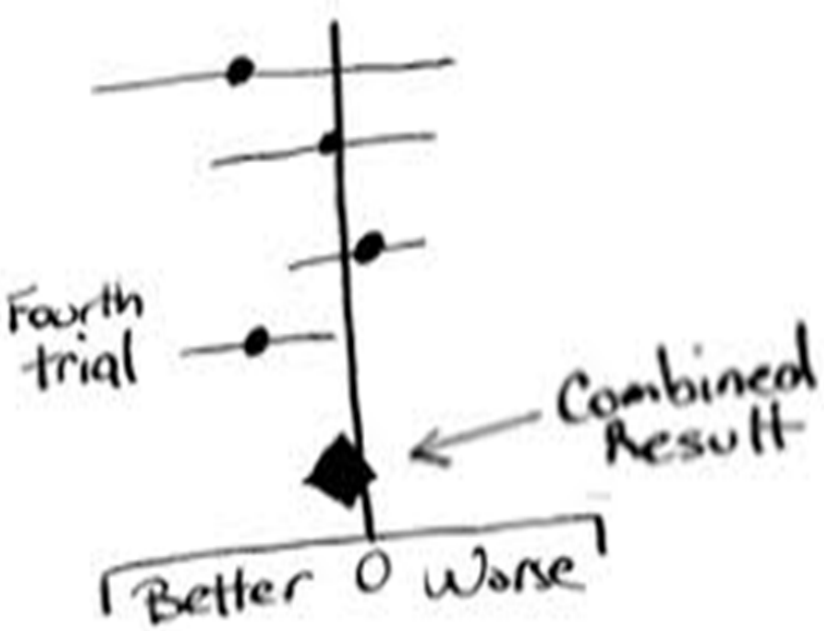
$$w = \frac{1}{S_d^2} = \frac{2 \cdot n_E \cdot n_C \cdot (n_E + n_C)}{2 \cdot (n_E + n_C)^2 + n_E \cdot n_C \cdot d^2}$$

K studies ,d_i ⟶ *j* categories

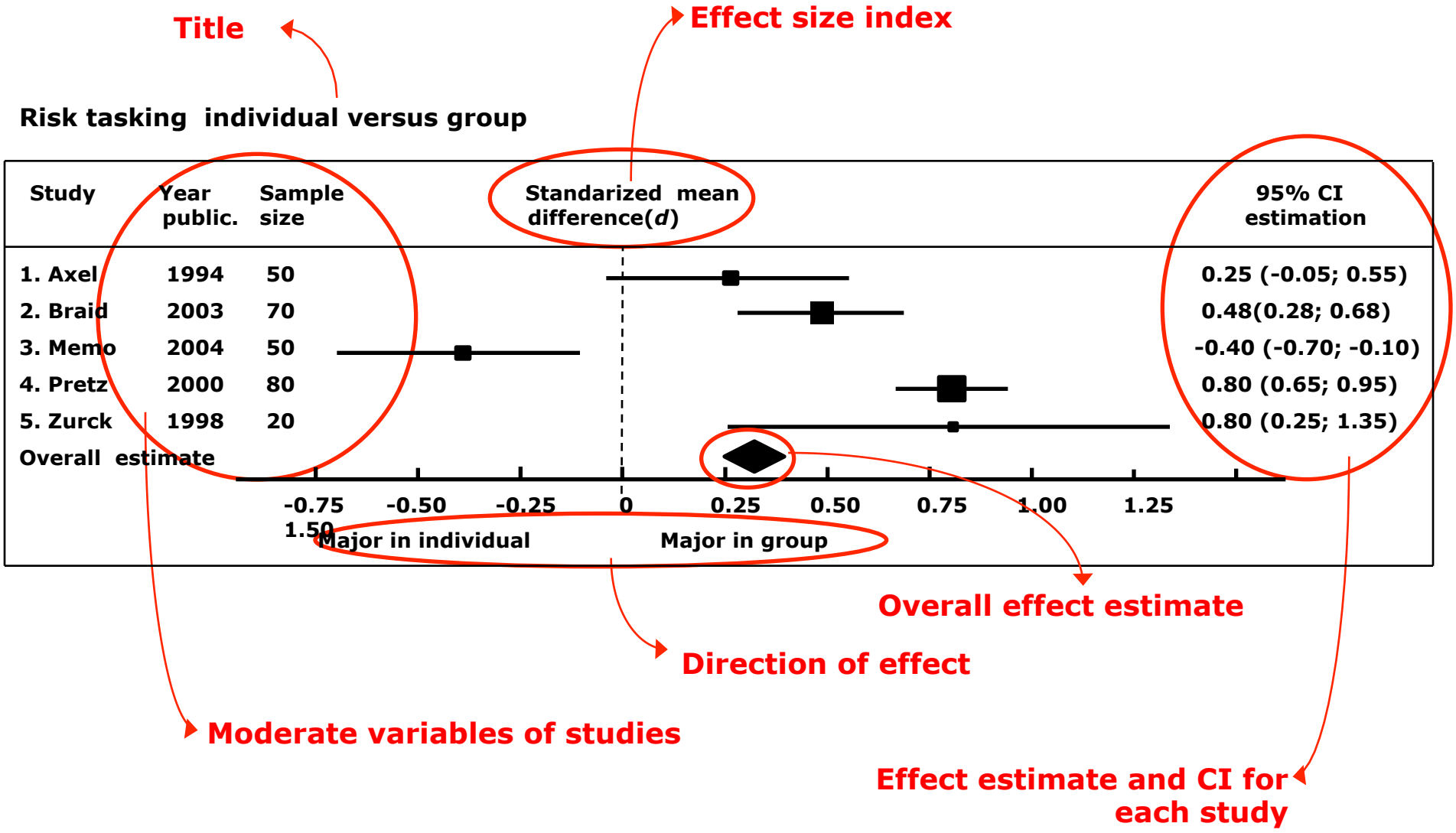
0.0	1
0.1	3
0.2	237
0.3	44569
0.4	13557
0.5	56779
0.6	01256789
0.7	3355688
0.8	1123368
0.9	23578
1.0	1458
1.1	23
1.2	4

0.0	1
0.1	3
0.2	237
0.3	44569
0.4	13557
0.5	56779
0.6	01256789
0.7	3355688
0.8	1123368
0.9	23578
1.0	1458
1.1	23
1.2	4

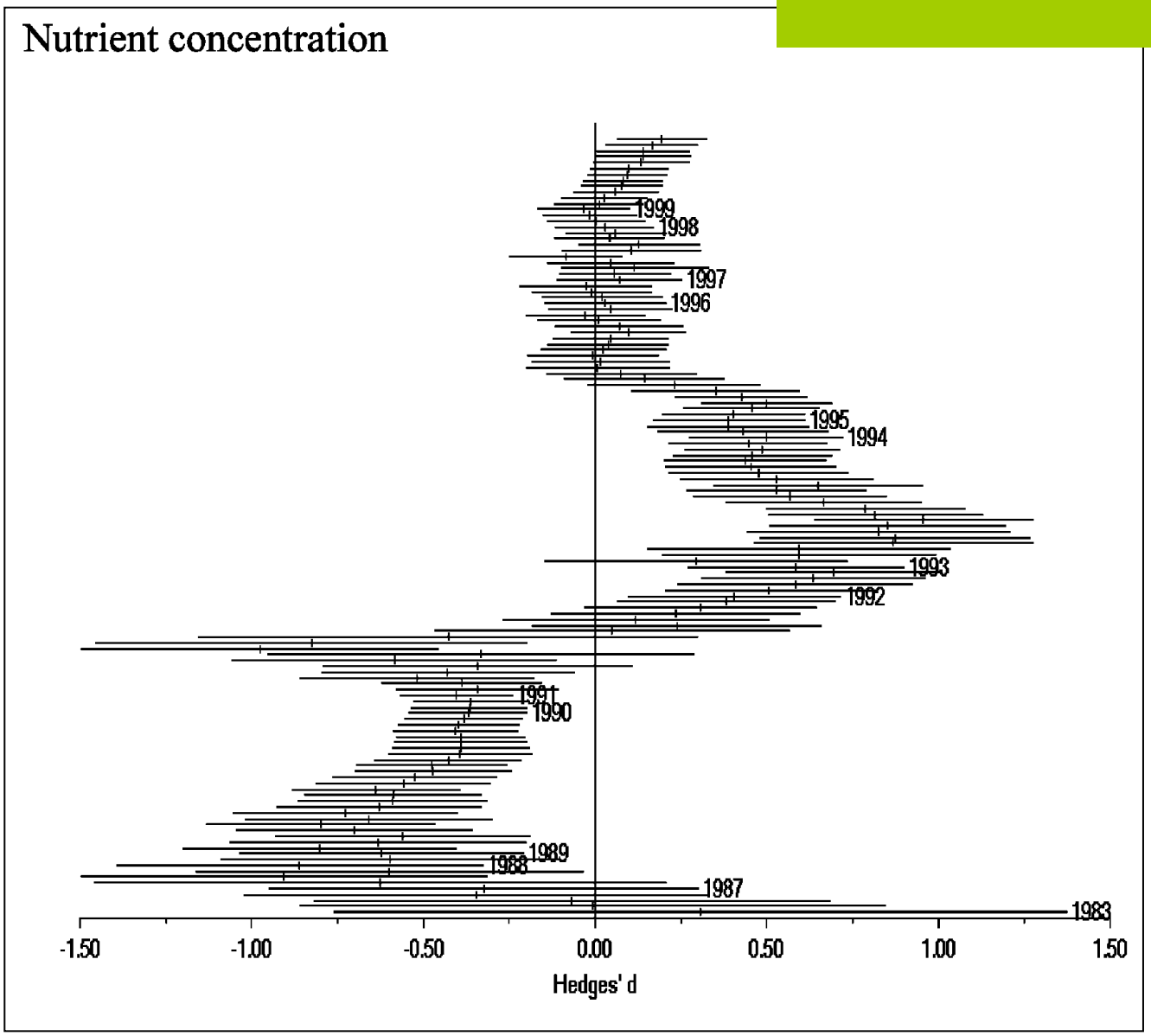
PRESENTING YOUR RESULTS
A FOREST OF LINES



Forest Plot


Title
Effect size index
Risk tasking individual versus group
Study
Year public.
Sample size
Standarized mean difference(d)
95% CI estimation
1. Axel 1994 50 0.25 (-0.05; 0.55)
2. Braid 2003 70 0.48(0.28; 0.68)
3. Memo 2004 50 -0.40 (-0.70; -0.10)
4. Pretz 2000 80 0.80 (0.65; 0.95)
5. Zurck 1998 20 0.80 (0.25; 1.35)
Overall estimate
-0.75 -0.50 -0.25 0 0.25 0.50 0.75 1.00 1.25 1.50
Major in individual
Major in group
Overall effect estimate
Direction of effect
Moderate variables of studies
Effect estimate and CI for each study

Forest Plot


Nutrient concentration
1999
1998
1997
1996
1995
1994
1993
1992
1991
1990
1989
1988
1987
1983
-1.50
-1.00
-0.50
0.00
0.50
1.00
1.50
Hedges' d

Publication bias problem

- Not all manuscripts are submitted
- Not all submitted manuscripts are pubished
- These selection processes are not random

Sources of publication bias

- Language (not english)
- Availability (not on the web)
- Cost
- Familiarity (who´s this?)
- Outcome (non significant results are less often pusblished)

The problem of the publication bias

K studies

CONCLUSIONS

¿How many studies **NOT** found and **NOT** significant could change my Meta-analysis results?

X studies
In the file drawer
(Rosenthal, 1979)

STEP 6. THE REPORT

1. **INTRODUCTION**

2. **METHOD**
   - Literature search and inclusion criteria
   - Coding
   - Analysis procedure

3. **RESULTS**

   Descriptive analysis of the research searching

   Integration results for the K studies:
   - Descriptive analysis
   - Inferential analysis (categorical models, regression…)

4. **DISCUSSION**

5. **REFERENCES***

6. **APPENDIX**

STEP 6. THE REPORT

PLEASE, COMPLETE CHECK LIST USING THE EXAMPLE

Weaknesses of Meta-analysis

- Requires a great deal of effort
- Mechanical aspects do not lend themselves to capturing more qualitative distinctions between studies
- “Apples and oranges” criticism

Strengths of Meta-analysis

- Imposes a discipline on the process of summing up research findings
- Represents findings in a more differentiated and precise manner than conventional reviews
- Capable of finding relationships across studies that are obscured in other approaches
- Can handle a large numbers of studies (this would overwhelm traditional approaches to review)

Final Comments

- Meta-analysis is a replicable method of synthesizing findings
- Meta-analysis often points out gaps. Future research
- Meta-analysis illustrates the importance of replication
- Meta-analysis facilitates generalization

Present and future of Meta-analysis: "collaborations"

Objetives

- **Avoid duplicity**
- **Support MA**
- **Approach scientific evidence to professional practice**

- **Cochrane Collaboration (www.cochrane.es)**

- **Campbell Collaboration (www.campbellcollaboration.org)**

CONCLUSION

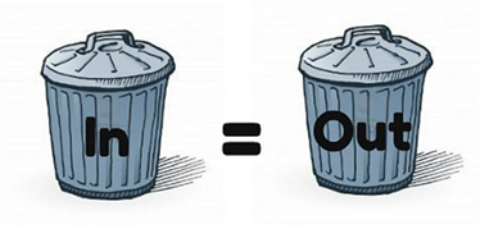
- Meta-analysis is a method for synthesising and analysing the research literature on a particular topic
- The essence of good science is replicable and generalisable results.
- Increasingly sophisticated
- Continuously evolving

Final Comments

- Replicable method of synthesizing findings
- Often points out gaps. Future research
- Illustrates the importance of replication
- Increasingly sophisticated and continuously evolving

Post seminar task
Questions

- What are the main advantages of a MA?
- What are the main steps in MA?
- What are the primary types of effect sizes?
- What kind of usual analysis do you know in a MA?
- What are the strengths and weaknesses of the MA?
- What do you think about including all kind of studies regardless of their quality?



THANKS

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